REMARKS

Claims 1, 3, 5-8, 10-13, 17, 19, 21-24, and 26-29 remain in the application. Claims 2, 4, 9, 14-16, 18, 20, 25, and 30-32 are withdrawn from consideration. Claims 1 and 17 are amended to recite a three-dimensional molecular switch assembly and to specify that the active molecules are switchable between two different states by an applied external electric field; basis is found in paragraphs 0006, 0009, and 0010. Claims 2-16 are amended to recite the three-dimensional molecular switch assembly. Claim 17 is further amended to emphasize that each layer is formed via molecular self-assembly, which finds support throughout the specification; note, e.g., paragraph 0055. New Claims 33-35, which depend directly or indirectly from Claim 1, are added to claim the bi-stable molecular color switch feature of the invention; basis is found in paragraphs 0006, 0007, and 0010. New Claims 36, which depends from Claim 1, is added to claim the bi-stable molecular switch feature of the invention; basis is found in paragraph 0050. New Claims 37-40, which depend directly or indirectly from Claim 17, are analogous to new Claims 33-36, respectively.

Claims 2, 4, 9, 14-18, 20, 25, 30-32 are presently withdrawn from further consideration as being drawing to a non-elected species. The Examiner states that there is no allowable generic or linking claim.

While this is true at this time (no allowable claim), Applicants note that Claims 1 and 17 are generic to the non-elected species. Upon allowance of a generic claim, Applicants expect that these claims will be brought back into the application.

Claims 3, 5, 8, 10, 19, 21, 24, and 26 are objected to as depending from withdrawn claims. The Examiner requires appropriate correction.

These claims all further limit the withdrawn claims from which they depend. If Applicants were to amend the dependencies of these claims at this time, then the possible allowance of a generic claim that would bring the non-elected claims back into the application would wreak havoc on Applicants' original claim structure. Accordingly, Applicants respectfully defer amending these claims until a resolution is reached as to the generic claims.

Reconsideration of the objection to Claims 3, 5, 8, 10, 19, 21, 24, and 26 as depending from withdrawn claims is respectfully requested.

Claims 1, 3, 5-8, 10-13, 17, 19, 21-24, and 26-29 are rejected under 35 USC 103(a) as being unpatentable over Devonald et al (U.S. Patent 5,275,924).

Devonald et al disclose amphiphilic compounds for sequential monolayer deposition. Specifically, amphiphilic compounds and oligomers and polymers derived therefrom are purportedly suitable for Langmuir-Blodgett (L-B) deposition, wherein the compounds have a polyamide backbone and hydrophobic groups pendant therefrom, which pendant groups preferably contain chromophore groups. The compounds are said to be used to form non-centrosymmetric bilayers and are said to be used for forming various non-linear optical elements.

Applicants' Claim 1, as amended, recites:

> 1. (currently amended) A three-dimensional molecular ***switch*** assembly, formed on a substrate, said molecular ***switch*** assembly comprising:
>
> a first monolayer of seed molecules for initiating self-assembled molecular growth, said first monolayer formed on said substrate;
>
> a second monolayer of active molecules comprising a plurality of rotor moieties and stator moieties, with one rotor moiety supported between two stator moieties, said second monolayer of active molecules formed on said first monolayer of seed molecules, with a one-to-one correspondence between molecules in said first monolayer and said second monolayer;
>
> a third monolayer of spacer molecules, formed on said second monolayer of active molecules, with a one-to-one correspondence between molecules in said second monolayer and said third monolayer; and
>
> a plurality of alternating second monolayers and third monolayers having said one-to-one correspondence,
>
> ***wherein said active molecules are switchable between two different states by an applied external electric field***. (Emphasis added.)

The Examiner argues that Devonald et al discloses a method for making Applicants' three-dimensional molecular assembly, citing Col. 10, lines 15-25 and 50-65.

However, the devices of Devonald et al are all directed to non-linear optical elements (e.g., Abstract; Col. 2, lines 65-68). There is absolutely no disclosure or suggestion that the molecules of Devonald et al are switchable between two different states by an applied electric field or that the molecules form a three-dimensional molecular switch assembly. As is well-known, non-linear optical devices operate on the principle that the refractive index of such non-linear optic material changes in accordance with the intensity of an impinging laser beam. Thus, the optical result is an analog function of the intensity of the incoming laser wavefront.

Applicants' invention differs significantly from that of non-linear optics in that their molecular switch is not ***analog*** but rather is ***digital*** ("ON-OFF") and the optical behavior of Applicants' switching molecules has no dependence on light coherence (e.g., laser dependence) or intensity. In the case of non-linear optics, the optical effect is determined by incoming light intensity. In Applicants' case, the optical effect is determined by the applied electric field.

The Examiner is silent regarding the teaching of Devonald et al regarding Applicants' active molecules, each comprising one rotor moiety supported between two stator moieties. The Examiner does make the curious statement: "Devonald does not explicitly claim his first stator molecule [connected to substrate] is a 'seed' molecule' (Office Action, page 4).

First, Applicants' stator moiety (actually, stator moieties) are located in the active molecules, not the seed molecules.

Second, Devonald et al are totally silent on any "stator" molecules. Applicants respectfully request that the Examiner cite the column and line number of such stator molecules (or, for that matter, rotor molecules). For at least this reason alone, the claims are considered to be patentable over the cited reference. To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974); MPEP § 2143.03.

Devonald et al is directed to amphiphilic compounds for sequential monolayer deposition, wherein the compounds have a polyimide backbone and hydrophobic groups pendant therefrom. The pendant groups may contain chromophore groups. The com-

pounds can purportedly be used to form non-centrosymmetric bilayers and are purportedly useful for forming various non-linear optical elements.

However, there is absolutely no disclosure or suggestion in this reference that a three-dimensional molecular assembly, comprising a first monolayer of "seed" molecules, a second monolayer of "active" molecules, and a third monolayer of "spacer" molecules, with a plurality of alternating second monolayers and third monolayers, can be formed, where the "seed" molecules initiate self-assembled molecular growth, the "active" molecules comprise a plurality of rotor moieties and stator moieties, and the "spacer" molecules provide spacing between layers.

Further, there is no disclosure or suggestion that this assembly can be placed between electrodes and an electric field applied to cause rotation of rotor moieties.

In particular, Devonald et al teach the sequential assembly of a bilayer comprising monolayers of an amphiphilic material, using Langmuir-Blodgett techniques (discussed further below). The amphiphilic material includes amide groups used to align the monomer layers and pendant non-linear optic chromphores. In this case, acceptor-donor groups on the chromophores of one layer complex with amide groups on a second layer to force the desired self-alignment of the chromophores within the bi-layer structure. The teachings are directed toward structures for non-linear optics, e.g., filters.

Applicants' specification and claims, on the other hand, are directed to the sequential molecular self-assembly of monolayers, wherein each monolayer is a chromophore having rotor-stator switching elements. These teachings are directed toward molecular electronics and color displays employing bi-stable switching.

In comparing the two technologies, it is first important to note that monolayer assembly of amphiphilic materials is well known and is the subject of many patents predating Devonald. For example, U.S. Patent 5,034,277 (1991) granted to Laschewsky et al teaches multi-layering of amphiphilic monolayers for non-linear optical applications. The important differences then are the specific chemistries that are assembled, as discussed above. The functional mechanism of the monolayers, chemistry and application are notably different.

For at least the foregoing reasons, Claims 1 and the claims dependent thereon are patentable over Devonald et al.

Turning now to the rejection of Claim 17 and the claims dependent thereon, Applicants' Claim 17, as amended, recites

> 17. (currently amended) A method for fabricating a three-dimensional ***switch*** molecular assembly, formed on a substrate, said method comprising:
>
> forming on said substrate a first monolayer of seed molecules for initiating ***self-assembled*** molecular growth;
>
> forming, ***via molecular self-assembly***, on said first monolayer a second monolayer of active molecules comprising a plurality of rotor moieties and stator moieties, with one rotor moiety supported between two stator moieties, with a one-to-one correspondence between molecules in said first monolayer and said second monolayer;
>
> forming, ***via molecular self-assembly***, on said second monolayer a third monolayer of spacer molecules, with a one-to-one correspondence between molecules in said second monolayer and said third monolayer; and
>
> forming, *via* ***via molecular self-assembly***, a plurality of alternating second monolayers and third monolayers having said one-to-one correspondence,
>
> ***wherein said active molecules are switchable between two different states by an applied external electric field***. (Emphasis added.)

With regard to independent Claim 17, the Examiner is attempting to equate the Langmuir-Blodgett assembly of layers (taught by Devonald et al) with molecular self-assembly of layers (claimed by Applicants). The distinction between the two is drawn in paragraphs 0013 and 0014 of Applicants' specification. These are quite different approaches to forming a sequence of monolayers, and the teaching of one hardly discloses or suggests the claiming of the other.

The prior art technique of L-B assembly is shown in Applicants' FIG. 1, and employs a pattern of head-head (H-H) molecules and tail-tail (T-T), where one end group is hydrophilic and one end group is hydrophobic. This is a physical assembly process.

Devonald et al employ bilayers with non-centrosymmetric order, using two compounds, I and II, set forth in Col. 3, where the two compounds are in hydrophobic-

hydrophobic (H-H) configuration. Such an L-B assembly, which relies only on an association between the two hydrophobic functional groups, i.e., a physical association, hardly suggests a molecular self-assembly process, wherein a chemical connection via ionic bonds or metal chelation (paragraph 0055) is used to assemble the various molecules (seed – active – spacer – active – spacer – etc.) as a three-dimensional assembly.

For at least these reasons, Claim 17 and the claims dependent thereon are patentable over Devonald et al.

New Claims 33-35, which depend directly or indirectly from Claim 1, are directed to a bi-stable molecular color switch, while new Claim 36, which depends from Claim 1, is directed to a bi-stable molecular switch. Devonald et al utterly fail to disclose or suggest such switches. Rather, this reference teaches the formation of various non-linear optical elements, which, as noted above, behave quite differently than Applicants' bi-stable molecular switches.

Claims 37-40 are analogous to Claims 33-36, respectively, and depend directly or indirectly from Claim 17.

Thus, for at least the foregoing reasons, Claims 33-40 are patentable over Devonald et al.

Reconsideration of the rejection of Claims 1, 3, 5-8, 10-13, 17, 19, 21-24, and 26-29, as amended, together with new Claims 33-40, as being unpatentable over Devonald et al is respectfully requested.

The Examiner cites Zhang et al (U.S. Patent 6,751,365 B1) and Vincent et al (U.S. Patent 6,809,956) as being relevant to the present application. These references, cited by Applicants in a previously-submitted Information Disclosure Statement, are considered to be exemplary of rotor-stator configurations of molecules and of displays incorporating, e.g., molecules having rotor-stator configuration, respectively.

The application is considered to be in condition for allowance. The Examiner is respectfully requested to take such action. If the Examiner has any questions, he is invited to contact the undersigned at the below-listed telephone number. HOWEVER, ALL WRITTEN COMMUNICATIONS SHOULD CONTINUE TO BE DIRECTED TO: IP AD-

MINISTRATION, LEGAL DEPARTMENT, M/S 35, HEWLETT-PACKARD COMPANY, P.O. BOX 272400, FORT COLLINS, CO 80527-2400.

Respectfully submitted,

June 21, 2006

David W. Collins
Reg. No. 26,857
Attorney for Applicants

512 E. Whitehouse Canyon Road
Suite 100
Green Valley, AZ 85614

Telephone calls may be made to:
(520) 399-3203